Use of pattern analysis for predicting heroin dependency

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USE OF PATTERN ANALYSIS FOR PREDICTING HEROIN DEPENDENCY

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THESIS

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FOR
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by

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June 1973

Approved for public release; distribution unlimited.

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Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

from the

[redacted]

ABSTRACT

The main objective of the thesis was two-fold:

(1) To apply and verify pattern analysis as an effective statistical tool in solving a practical problem.

(2) To gain insight into the historical/biographical factors that may be used to predict heroin dependency.

To accomplish this goal, a thirty-six item questionnaire was developed from research into the background of heroin addicts. This inventory was administered to patients at methadone clinics and students at junior colleges in the San Francisco and Monterey Bay areas. Their responses were then fed into a validation and cross-validation program based on pattern analysis. This resulted in various patterns of yes/no responses, with corresponding correlation coefficients and probabilities of heroin dependency. The tables derived from the computer output proved to be a statistically valid prediction tool.

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I. INTRODUCTION

Personal inventory tests are a common tool as a behavior or performance predictor. The majority of them are attitude-oriented and attempt to isolate individual factors. The utility of these devices is questionable when one considers the objectivity and reliability of data that cannot be documented or that are altered with changes in the subjects' temperament or mood.

This study is concerned with developing an alternative approach to questionnaire format and analysis. The items emphasize historical/biographical facts, as opposed to feelings or opinions. The advantage of this approach is that the responses are reliable over time and are verifiable to the administrator, as well as to the subject. The data analysis also involves a new technique referred to as pattern analysis. In this technique, a small number of items are selected from a larger number for their ability to predict criterion performance. Each pattern of responses to the selected items is assigned a score, called a pattern score, that is equal to the mean score on the criterion of all individuals who have the pattern in a validation group. The selection of items depends not on the correlation of responses to individual items but on the correlation of pattern scores with criterion performance. The Naval Postgraduate School Master's theses of K. P. Weinberg and B. F. Folce, Jr., describe the technique in detail.

An application of this technique is the primary goal of the current investigation. The objective, in particular, is to develop a table that can predict a young adult's potential for heroin dependency. A questionnaire or inventory composed of thirty-four fact-oriented items, each attempting to assess sociological characteristics evident in heroin addicts' case histories and in drug-related studies, was developed and administered to San Francisco Bay-area methadone patients and junior college students. The responses obtained formed a data base which was analyzed by a pattern-analysis computer program.

II. PRELIMINARY RESEARCH

Preparations for the investigation may be grouped into three general areas: literature review, case history analysis and interviews, and pilot study.

The studies in sociocultural correlates of abuse have been reviewed and summarized in a recent article by Braucat, Brakarsh, Fallingstad, and Berry of the University of Denver in Psychological Bulletin, February, 1973. The authors report that the majority of research has focused on the family environment of the adolescent addict. Family fragmentation in the form of either actual loss [Valiant, 1966] or the separation of the parents [Rosenberg, 1968] has frequently been observed in the family backgrounds of young addicts. In one study, Rosenberg [1969] found that less than half of the addicts had reached the age of 15 with their natural parents continuously living at home.

Addicts have generally been found to have parents of extreme personality types, but there is no agreement on the exact nature of this personality type. Three major personality types are generally discussed: (1) the overprotecting parent [Ausabel, 1961; Bender, 1963; and Lackowitz, 1961], (2) the underdominating parent [Ausabel, 1961; Bender, 1963; and Rosenberg, 1968], and (3) the overdominating parent [Ausabel, 1961; Bender, 1963; and Zimmering, 1958].

Parental rejection during the formative years is another theme frequently discussed [Rosenberg, 1969]. Hirsh's theory [1961] suggested that sons who are infantilized by rejecting narcissant mothers are prone to addiction. Gold [1957] suggested that rejecting families produce insecure feelings which lead to addiction. Rosenberg [1968, 1969] concluded that the early life of addicts was marked by either a general physical lack of parental models or the presence of inadequate ones, as indicated by the high degree of parental alcohol abuse or mental or physical illness. Obviously there is a lack of agreement as to specifics in these studies, but the literature generally points to a conclusion that the adolescent addict suffers from inadequate parental models or absence of one or both parents.

Chien [1959], Bender [1963], and Valiant [1966] have studied the ethnic composition of young addicts. They agreed that most addicts are members of a minority community. There are two possible implications of this finding; (1) being a member of an ethnic minority may lead to racial discrimination [Murray, 1967, and Zimmering, 1952, found racial discrimination to be a relevant factor in narcotic addiction] and (2) Valiant's [1966] sample of adolescents are not only from minority groups but, also, first generation Americans. This finding may point to the fact that one of the sociological variables relevant to addiction is a cultural clash between parent and child. These three researchers also found that narcotic addicts are generally

found in urban and metropolitan areas. These addicts usually grow up in poor residential areas where there is a high availability of narcotics, and it is this availability which helps to determine who becomes an addict.

Studies by Cameron [1963], Ganso & Mason [1958], Modlin & Montes [1964], Scher [1966], and Valiant [1966] have shown that adolescent addiction is usually connected with peer-group enticement. Little and Rearson [1966] attribute the perpetration of drug addiction to the interdependence of an addict and others whom the addict persuades to experiment with narcotics.

Summarizing, the research reveals that the adolescent narcotic addict is frequently a member of an ethnic minority and often from a poor urban environment. Furthermore, the research points to the fact that addicts either have deficient parental models or no model at all. Peer-group enticement and availability are points of agreement in the research, as well.

In order to substantiate the factors revealed in the literature review and to have a real-life input into the inventory developed for this study, case histories of heroin abusers were examined, and interviews with former heroin addicts conducted. Case workers at a juvenile probation center made 25 anonymous files available. The majority of the factors listed in the literature (i.e., broken homes, inferior school records, poor peer and sibling influences, and lack of

activities or interests) recurred in the biographies. Several former heroin addicts who were asked to evaluate these factors for relevancy, generally felt them to be very applicable to the experiences of individuals with a history of narcotic use.

In the final phase of the preliminary investigation a pilot study was conducted. The questionnaire tentatively developed was administered to patients at the Monterey and Salinas Methadone Centers as well as students at Hartnell Junior College and Monterey Peninsula College. The data sample collected consisted of 50 addicts and 70 non-addicts. Using these data the validation computer program was debugged and all unanswerable or confusing questions were corrected. The results of the pattern analysis applied to this small sample were very encouraging. Table I describes the output of the validation program. A validation correlation coefficient of .76 was achieved for a selection of four questions that produced sixteen patterns of yes/no responses. A cross-validation analysis was not feasible at this point because of the small sample, but the findings of the pilot study were encouraging.

Table I

Pilot Study Item Selection

Question	Resulting Patterns	Question Series	Correlation Coefficient
12	2	12	.46495
23	4	12-23	.56197
4	8	12-23-4	.62591
22	16	12-23-4-22	.76189

Text

Question Number	
12	It took me four years to receive my diploma from high school (grades 9-12).
23	I have been punished or suspended from school for tardiness or truancy.
4	My father served on active duty in the military.
22	I have been placed on juvenile probation.

III. SUBJECTS

Methadone-center patients and junior-college students in the San Francisco and Monterey Bay area were used as the addict and non-addict subjects. The sample included respondents from urban, suburban, and rural areas, representing an evidently adequate cross-section of the area's population in regard to economic, educational, and social characteristics. Choosing a non-addict sample that was relatively free from such institutional bias as the necessary high school graduation of university students was a primary concern in the subject selection. Junior-college students were chosen because they would seem to provide the most representative sample of the general youth population available in the study areas.

Participation was on a voluntary basis. One hundred and sixty-eight addict and 462 non-addict subjects completed and returned the questionnaire (see Table II). Approximately 15% of the addict and 6% of the non-addict responses were unusable because of failure to answer all questions.

Table II

Geographical Distribution of Sample

Addict Sample

Center Location	Total Number Distributed	Number Returned and Usable
Salinas	35	30
Monterey	25	23
San Jose	600	53
Berkeley	90	17
East Oakland	15	0
West Oakland	150	0
San Mateo	35	28
Santa Cruz	65	0

Non-Addict Sample

San Jose City College	250	196
De Anza Junior College	130	117
Gavilan Junior College	120	113

IV. METHOD

Using the results of the preliminary research, the final questionnaire was formulated. In keeping with the initial objective, the items were worded so that they were historical/biographical in nature, easily verifiable by the subject and the administrator, and provided for a dichotomous response ("yes" or "no"). This format differs markedly from most questionnaires in that it is not attitude-oriented. Attitude questionnaires may be of little value in that a person's response set for attitude questions may vary from day to day. The information derived from the types of questions used here is historical and factual and, thus, remains constant throughout time. (See Appendix A for a sample questionnaire and a listing of the questions and reasons for their formulation.) These questions represent an attempt to meet the requirements for disclosing as many factors about a person's sociological history as possible. The items were worded both in the positive and negative. This prevents the subject from developing an all-positive or all-negative response set.

After dissemination and collection of the inventories (see Table II) and division into cross-validation and validation groups, the data were subjected to pattern analysis by computer programs. The key to pattern analysis is that the yes/no answer to the questions only have

meaning when they are viewed as a pattern of responses. Each item must be considered in relation to the other items. To illustrate this point in the current application, previously selected items were excluded and new items were selected from those remaining. (See Results section for a more detailed explanation of how pattern analysis relates to this study.)

From the results of the validation and cross-validation computer programs for pattern analysis, a table displaying all the response patterns and their mean criterion or "pattern" scores was constructed.

V. RESULTS

A. VALIDATION

Item responses consisted of 0's and 1's corresponding to positive and negative answers. Criterion measurements consisted of 0's and 1's corresponding, respectively, to non-drug addiction and drug-addiction. The validation program reviewed 383 responses to each of the 34 questionnaire items and selected the item that produced the highest correlation with the addict/non-addict criterion (question 12, Table III). After computing the correlation coefficient, the program reexamined the data, retaining the selected item, to find the second item which, together with the already selected item, would be most predictive. The second item selected was 23, concerning juvenile probation. The following decision tree illustrates the four (2^2) possible patterns that can result from the selection of these two items.

			yes
	yes	Juvenile probation	
High school diploma			no
	no	Juvenile probation	yes
			no

The cycle was continued until six items (64 patterns) were selected. Correlation coefficients were computed for the patterns produced by each additional item. Table III shows the results.

Table III

Best Items for Pattern Analysis

Question	Resulting Patterns	Question Series	Correlation Coefficient
12	2	12	.44576
22	4	12-22	.53677
4	8	12-22-4	.59982
32	16	12-22-4-32	.64588
6	32	12-22-4-32-6	.70552
33	64	12-22-4-32-6-33	.76919

Question Number	Text
12	It took me four years to receive my diploma from high school (grades 9-12).
22	I have been placed on juvenile probation.
4	My father served on active duty in the military.
32	A doctor has prescribed sleeping medication or tranquilizers for my mother or father at least once.
6	Prior to my 18th birthday, I lived, for more than a year, with persons other than my parents.
33	I have applied for admission to two or more colleges or junior colleges.

After selecting the best six items, the validation program was run two additional times, but excluding questions 12, 23, and 32 for one, and 4, 12, and 33 for the other. This was done to determine other factors related to heroin addiction and to illustrate the inter-dependency of questions in pattern analysis. Tables IV and V show the results.

Table IV

Best Items for Pattern Analysis (12, 23, 33, excluded)

Question	Resulting Patterns	Question Series	Correlation Coefficient
21	2	21	.41892
4	4	21-4	.49382
6	8	21-4-6	.54783
16	16	21-4-6-16	.59637
9	32	21-4-6-16-9	.65030
30	64	21-4-6-16-9-30	.73197

Question Number	Text
21	I have an older brother or sister who has been placed on juvenile probation or arrested.
4	My father served on active duty in the military.
6	Prior to my 18th birthday, I lived, for more than a year, with persons other than my parents.
16	One of my grandparents speaks a language other than English.
9	While in high school, I participated in a club, activity, or sport for a year or more.
30	My father has been fired from a job more than once.

Table V

Best Items for Pattern Analysis (4, 12, 33, excluded)

Question	Resulting Patterns	Question Series	Correlation Coefficient
20	2	20	.41892
5	4	20-5	.47956
15	8	20-5-15	.52584
24	16	20-5-15-24	.57554
31	32	20-5-15-24-31	.63419
8	64	20-5-15-24-31-8	.69766

Question Number	Text
20	I come from a family of four or more children.
5	Prior to my 18th birthday, my natural parents were not living together due to divorce, separation, or death.
15	Prior to my 18th birthday, I lived in four different states for a year or more.
24	I was employed at least 10 hours per week during the school year while I was in high school.
31	My mother or father is or has been an alcoholic.
8	At, or around, my 18th birthday, the combined income of my family was over $10,000 a year.

B. CROSS VALIDATION

Using the three sets of six items selected in the validation section, a group of 191 subjects were subjected to the cross-validation program. The cross validation performs four tasks:

1. Identifies the pattern for each subject in both validation and cross-validation groups.

2. Computes a mean criterion score for each pattern based on the validation subjects.

3. Indicates the number of validation subjects having each pattern.

4. Determines a cross-validation correlation coefficient.

The cross-validation program was run on each of the three sets of validation-selected items four times, one time each for 8, 16, 32, and 64 patterns. The tables to follow show the results for 8 and 16 patterns for the set of items selected from all the items and for 16 patterns for the two sets with excluded items.

The mean criterion scores are based on a validation sample which contained 25% addicts and 75% non-addicts. If one were to predict addiction by chance the mean criterion score would be .2500. To determine which mean criterion scores are significantly different from chance, with a 90% confidence level, the following interval was used:

$$.25 \pm 1.64 \sqrt{\frac{.25(1-.25)}{N}}$$

where N = number of subjects having the pattern.

The patterns that have mean criterion scores that lie outside this interval are significant predictors. Table VI shows the actual intervals which correspond to the 8 patterns in Table VII. In Tables

VIII, IX, and X the significant patterns are indicated by "yes", non-significant patterns by "no".

TABLE VI

Significant Patterns

Pattern	Mean Criterion Score	Subjects	Confidence Limit Lower	Upper	Significant
1.	.35484	31	.12166	.37833	no
2.	1.00000	7	-.02004	.52004	yes
3.	.10667	150	.19166	.30833	yes
4.	.07527	93	.17592	.32408	yes
5.	.54545	22	.09768	.40232	yes
6.	.94444	18	.08160	.41840	yes
7.	.34483	29	.11733	.38267	no
8.	.56522	23	.10102	.39897	yes

TABLE VII

Cross Validation on Questions 12, 22, 4

Pattern Number	Binary Code	Yes/No Pattern	Mean Criterion Score	Subjects in Pattern	Significant Score
1	000	YYY	.35484	31	no
2	001	YYN	1.00000	7	yes
3	010	YNY	.10667	150	yes
4	011	YNN	.07527	93	yes
5	100	NYY	.54545	22	yes
6	101	NYN	.94444	18	yes
7	110	NNY	.34483	.29	no
8	111	NNN	.56522	23	yes

Validation Correlation Coefficient: .59982

Cross Validation Coefficient: 53726

TABLE VIII

Cross Validation on Questions 12, 22, 4, 32

Pattern Number	Binary Code	Yes/No Pattern	Mean Criterion Score	Subjects in Pattern	Significant Score
1	0000	YYYY	.50000	20	yes
2	0001	YYYN	.09091	11	no
3	0010	YYNY	1.00000	4	yes
4	0011	YYNN	1.00000	3	yes
5	0100	YNYY	.09091	55	yes
6	0101	YNYN	.11579	95	yes
7	0110	YNNY	.07407	27	yes
8	0111	YNNN	.07576	66	yes
9	1000	NYYY	.53846	13	yes
10	1001	NYYN	.55556	9	yes
11	1010	NYNY	.91669	12	yes
12	1011	NYNN	1.00000	6	yes
13	1100	NNYY	.13333	15	no
14	1101	NNYN	.57143	14	yes
15	1110	NNNY	.72727	11	yes
16	1111	NNNN	.41667	12	no

Validation Correlation Coefficient: .64588

Cross Validation Coefficient: 50437

TABLE IX

Cross Validation on Questions 20, 5, 15, 24

Pattern Number	Binary Code	Yes/No Pattern	Mean Criterion Score	Subjects in Pattern	Significant Score
1	0000	YYYY	.50000	2	no
2	0001	YYYN	.75000	4	yes
3	0010	YYNY	.50000	22	yes
4	0011	YYNN	.37931	29	no
5	0100	YNYY	.12500	8	no
6	0101	YNYN	.33330	56	no
7	0110	YNNY	.21053	57	no
8	0111	YNNN	.18750	64	no
9	1000	NYYY	.75000	4	yes
10	1001	NYYN	.00000	1	no
11	1010	NYNY	.39130	23	no
12	1011	NYNN	.25806	31	no
13	1100	NNYY	.33333	3	no
14	1101	NNYN	.00000	8	no
15	1110	NNNY	.12500	40	yes
16	1111	NNNN	.19718	71	no

Validation Correlation Coefficient: .57544

Cross Validation Coefficient: .16266

TABLE X

Cross Validation on Questions 21, 4, 6, 16

Pattern Number	Binary Code	Yes/No Pattern	Mean Criterion Score	Subjects in Pattern	Significant Score
1	0000	YYYY	.20000	5	no
2	0001	YYYN	.16667	6	no
3	0010	YYNY	.10000	10	yes
4	0011	YYNN	.00000	7	no
5	0100	YNYY	.57143	7	yes
6	0101	YNYN	1.00000	2	yes
7	0110	YNNY	.44444	9	yes
8	0111	YNNN	.16667	6	yes
9	1000	NYYY	.42105	19	no
10	1001	NYYN	.66667	18	yes
11	1010	NYNY	.16667	84	yes
12	1011	NYNN	.14458	83	yes
13	1100	NNYY	.77778	9	yes
14	1101	NNYN	.63636	11	yes
15	1110	NNNY	.17188	64	no
16	1111	NNNN	.24242	33	no

Validation Correlation Coefficient: .59637

Cross Validation Coefficient: .36577

VI. DISCUSSION

The results of the validation program highlighted some important aspects of pattern analysis. When the validation program was applied to the entire 34 items, six questions which, together, were most predictive of drug addiction were selected. These six questions only correlate highly with addiction when they produce a pattern of responses. A "yes" or a "no" answer to each question is not in itself predictive.

For example, question 32, chosen as one of the best six questions, asked if an individual's parents ever used prescribed tranquilizers. One may assume, because of face validity, that a positive response to the question is indicative of drug dependency. However, a review of the cross-validation-program output for the six questions reveals that both positive and negative responses signify drug dependency in patterns with the other questions.

In Table VIII, patterns 3 and 4 illustrate this point. Pattern 3 (YYNY) has a pattern score of 1.0 with question 32 receiving a positive response. The fourth pattern (YYNN) also has a 1.0 pattern score, although it has a negative response to question 32. Clearly, question 32 cannot be used as an individual predictor. It is only relevant to heroin dependency when used as one element in a series or pattern of questions.

The second and third runs of the validation program, which excluded three of the items, illustrate another facet of pattern analysis that prevents one from generalizing concerning an item's individual predictability.

Question 22, the second item chosen in the first validation run, is a case in point. When question 12 was eliminated question 22 ceased to be relevant with regard to the other questions. It did not appear in either of the other two outputs, even though it was selected second in the first output. In other words, the question on juvenile probation is most relevant to heroin dependency when used in conjunction with a response to the subject's high school education level.

The results of cross validation reveal that, because of limited sample size, only the 8 and 16 pattern outputs for the items selected from the set which included all questions are valid predictors. The 32 and 64 pattern outputs were handicapped by the poor distribution of subjects that caused some patterns to be void of subjects and some subjects not to have any pattern. Thus, the cross-validation correlation coefficient dropped significantly from the validation coefficient (32 patterns: .70552 to .44973; 64 patterns: .76919 to .38832). The 8 and 16 patterns, with sufficient distribution and with a substantial number of subjects for each pattern, held up rather well under cross-validation (8 patterns: .59982 to .53726; 16 patterns: .64588 to .50437).

The cross-validation analysis applied to the questions derived from the diminished item set (the second and third validation runs) resulted in too poor a pattern distribution to produce a valid predictive tool. The 16 patterns associated with question 20, 5, 15, and 24 had a cross-validation drop of from .57544 to .16266. The patterns derived from questions 21, 4, 6, and 16 had a cross-validation drop of from .59637 to .36577.

The stated objective of the study was to develop a tool which may be used to predict which young adults may become heroin dependent. An illustration using questions 12, 22, 4, and 32 may show that the objective has been accomplished. If these four questions were administered to a random sample of young adults, their resulting patterns of responses could be analyzed for prediction using Table VIII. If a subject answered the 4 questions according to pattern 5 (YNYY), the table indicates that he has a .09091 chance of being heroin-dependent in a population having 25% heroin-dependent people. Thus, it would be reasonable to assume that he may be referred to as a non-addict. A subject responding in accordance with pattern 11, on the other hand, may be considered a potential heroin addict.

To summarize, the results have generally shown some of the important characteristics of pattern analysis.

1. Questions are chosen purely for their predictability when used in conjunction with other questions.

2. Individual predictive validity of each question cannot be inferred from their selection in pattern analysis.

3. Face validity of the questions are of little value in determining what questions will be selected, or what the pattern scores for specific patterns will be.

Although there was a restricted number of subjects involved in this study, the cross-validation correlation coefficients for the 8 and 16 pattern outputs were high enough (.54 and .50) to warrant the use of the associated tables for making predictions. The limited addict sample did, however, prevent the 32 and 64 pattern outputs from holding up under cross validation. With a larger addict population, these two tables, with such high validation correlation coefficients, might also provide an even more useful tool for forecasting heroin-dependency problems.

APPENDIX A

QUESTION BACKGROUND AND FORMAT

1. My natural mother and father are both high school graduates.

This question was designed to establish the educational environment in which the child was raised. It also may help determine the family's economic and social standing.

2. Prior to my 18th birthday, my father never worked a night shift.

From our background studies, we know that broken homes and poor parental relationships are two factors prevalent in the case studies. This question is one of several that is to indicate a lack of parental guidance. It also may depict a family's economic level through the father's occupation.

3. Prior to my sixth birthday, my mother held a steady job.

This question is very similar to question #2. Again it is indicative of a family's economic level, possible parental separation, or lack of a sufficient mother image.

4. My father served on active duty in the military.

This question may point out any physical deficiencies of the father that prevented him from being in the military, as well as possible separation from the father for an extended period of time.

5. Prior to my 18th birthday, my natural parents lived together in my home.

This question was formulated to find out directly if there have been any marital problems or separation due to divorce or death. This is one factor that was most prevalent in our examination of case studies and literature review. Hopefully, it will be one of the questions that will best indicate the future addict.

6. Prior to my 18th birthday, I lived for a year or more, with persons other than my parents.

The response to this question, coupled with responses to questions concerning parent's arrest record, divorce, or his probation record, could show that he was placed in a foster home, with relatives, or was placed in a probation center.

7. My father has been arrested by the police for something other than a traffic violation.

Another important indicator is the environment the addict was brought up in and the example set by the parents, brothers, sisters, and peers. This question may show a poor example set by the father in the family.

8. At, or around, my 18th birthday, the combined income of my family was over $10,000 a year.

Obviously, this question is to set the economic level of the family. This question alone may be insignificant, but put in a pattern with other responses, should be a key question in the prediction of a future addict.

9. While in high school, I participated in a club, activity, or sport for a year or more (e.g., chorus, basketball, student council, chess club).

School record and attendance were two areas that showed the biggest difference between the addict and the non-addict. The addict tended to avoid school affairs, have poor attendance records, be punished by school officials, and, consequently, have poor grades. This is one of a few questions designed to review this facet of the person's life.

10. My parents are both of the Protestant religion.

This question is designed to inquire as to the religious background of the individual. The literature review indicated that different religious groups tended to have different probabilities of dependencies.

11. I have been confirmed, barmizvahed, or baptised.

Again, religion is the area concerned here. This question is concerned more on whether the parents had their children confirmed in a religious belief. This again may help determine to what extent the parents showed an interest in their child's upbringing.

12. It took me four years to receive my diploma from high school.

This obviously is to determine whether the person taking the test has graduated from high school. This question goes along with the poor attendance and no activities. It may be somewhat biased in that the addict may have become addicted prior to graduation and dropped out.

13. Between the ages of 12 and 18, I lived for at least three years within 100 miles of an ocean.

This question points to the environment the person has grown up in. For the most part, the East and West Coasts are generally regarded as more liberal than the Midwest region. Also, drugs may be more attainable in these areas. By plotting the list of the methadone centers on a map, we verified this assumption, noting that the vast majority of centers are located on or near the two coasts.

14. For most of my life, I have lived within 50 miles of a major city (500,000 population or more).

Again, this question tries to determine the person's environmental background. This question, coupled with others, could point to the person's living in a highly populated urban situation, thus increasing his chances of being exposed to heroin.

15. Prior to my 18th birthday, I lived in four different states for a year or more each.

This question will show the mobility of the family. If he answers "yes" to this question, he must have been forced to adapt to several different situations. This factor could or could not be important, depending on how smoothly the adjustment was made.

16. One of my grandparents speaks a language other than English.

This question is designed to see if his family has recently come to the U.S. Our literature review reveals that children of first-generation Americans tend to rebel against their parents and are more likely to experiment with narcotics.

17. I am of European or Asiatic descent.

This is an attempt to determine the race of the individual. Race by itself may not be important, but along with environment, economic status, and education, could be an important variable.

18. Prior to my 18th birthday, my family lived primarily in rented houses or apartments.

This question has several possible angles. First, it could show the person lived in an urban area in that most people rent in cities. It could show the economic level of the family. Also, it might give a clue as to the mobility of the family, never staying in one place long enough to own a home.

19. I have at least one older brother or sister.

20. I come from a family of four or more children.

21. I have an older brother or sister who has been arrested or has been placed on juvenile probation.

These questions are an attempt to determine what size family the person comes from, whether he has any older brothers or sisters, and whether the brothers or sisters set poor examples. Our case studies show that the addicts may come from a large family where he may get little or no attention and with older brothers and sisters who have set bad examples. Also, a large number of brothers and sisters may indicate that he may come from a broken home and live with stepbrothers and sisters.

22. I have been placed on juvenile probation.

This is to determine if the subject has had any dealings with the law. The case studies show that heroin abusers usually had been placed on probation prior to addiction. The fact may exist that they first became addicts, then resorted to stealing to support their habit.

23. I have been punished or suspended from school for tardiness or truancy.

This is another attempt to determine his school background. If the person answers in the affirmative to this question, he probably did poorly in his studies and did not graduate. Again the addict may have become dependent during high school and was truant from school in order to support their habit.

24. I was employed at least 10 hours per week during the school year while I was in high school.

This question is another school oriented question. Here we try to uncover any activities outside of the school. It also may tell what the economic condition of his family was.

25. Prior to my 18th birthday, I spent the night in a hospital on at least four different occasions.

The health record of the individual was another area we were concerned with. A person with a record of illness may be used to taking drugs and injections. The fact that the person spent four nights in a hospital on separate occasions may also say something about his economic status, especially in these days of rising medical costs.

26. None of my close friends has been placed on juvenile probation.

The addicts we studied usually have friends who introduced them into their problems. In almost every case study the subject was associated with people who were also on probation.

27. I have an older brother or sister who has been divorced.

Again the broken home pattern is trying to be uncovered here. This factor was such an important facet of the addicts we reviewed that we repeated the theme in several questions.

28. Prior to my 18th birthday, I had flown in an airplane.

This question is to determine the economic level of the family and the experience the subject has had in adjusting to different situations. A person who has not flown in an airplane may have had a limited exposure to different situations or may come from a low income family that was forced to travel by more inexpensive means.

29. Prior to my 18th birthday, my parents, in addition to their normal income, received money from social security benefits, alimony, disability payments, welfare, or unemployment checks.

This attempts to uncover any additional sources of income that may subsidize the low-income family. Not only does it depict the economic level, but it also touches on the broken-home and family-health aspect as well.

30. My father has not been fired from a job more than once.

This is an attempt to determine the stability of the father image and determine the example set in the home.

31. My mother or father is or has been an alcoholic.

Again if a person is brought up in an atmosphere where one drug is abused, our literature study shows the person is more likely to abuse drugs himself. Hopefully, in an anonymous questionnaire, the participant will answer this question honestly and it should be a good indicator.

32. A doctor has prescribed sleeping medication or tranquilizers for my mother or father at least once.

This question is directed to the use of drugs in the home. Also the fact that sleeping pills and tranquilizers were needed may mean that there were problems present that required the use of them.

33. I have applied for admission to two or more colleges or junior colleges.

High school record and ambition were the two areas that we were trying to measure here. If the person lacked the necessary requirements, it is doubtful that he would apply to two junior colleges.

34. While I was between the 6th and 12th grade, my mother or father visited a doctor regularly for a year or more.

This is another attempt to determine if there were any health (both mental and physical) disorders that have caused problems at home.

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ACKNOWLEDGEMENTS

We express our appreciation to a wide spectrum of individuals for their cooperation in this endeavor:

To the methadone clinics and junior colleges, whose participation was such an integral part of the study. Special thanks to Mr. Avais Morris, Director of the Monterey Methadone Center.

To our thesis advisor, Professor Ronald A. Weitzman, whose guidance enabled us to successfully complete our study.

To our wives, Anne and Barbara, whose patience and assistance will always be remembered.

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DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

ORIGINATING ACTIVITY (Corporate author)
Naval Postgraduate School
Monterey, California 93940

2a. REPORT SECURITY CLASSIFICATION
Unclassified

2b. GROUP

REPORT TITLE
Use of Pattern Analysis for Predicting Heroin Dependency

DESCRIPTIVE NOTES (Type of report and, inclusive dates)
Master's Thesis; June 1973

AUTHOR(S) (First name, middle initial, last name)
Raymond A. Ritchey
Robert L. Spahr

REPORT DATE
June 1973

7a. TOTAL NO. OF PAGES
39

7b. NO. OF REFS
3

. CONTRACT OR GRANT NO.

. PROJECT NO.

9a. ORIGINATOR'S REPORT NUMBER(S)

9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)

. DISTRIBUTION STATEMENT
Approved for public release; distribution unlimited.

. SUPPLEMENTARY NOTES

12. SPONSORING MILITARY ACTIVITY
Naval Postgraduate School
Monterey, California 93940

. ABSTRACT

The main objective of the thesis was two-fold:

(1) To apply and verify pattern analysis as an effective statistical tool in solving a practical problem.
(2) To gain insight into the historical/biographical factors that may be used to predict heroin dependency.

To accomplish this goal, a thirty-six item questionnaire was developed from research into the background of heroin addicts. This inventory was administered to patients at methadone clinics and students at junior colleges in the San Francisco and Monterey Bay areas. Their responses were then fed into a validation and cross-validation program based on pattern analysis. This resulted in various patterns of yes/no responses, with corresponding correlation coefficients and probabilities of heroin dependency. The tables derived from the computer output proved to be a statistically valid prediction tool.

D FORM 1 NOV 68 1473 (PAGE 1)
N 0101-807-6811

A-31408

KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Pattern Analysis						
Heroin Dependency Factors						

28 JAN 74
5 JUN 81
22470
27665

Thesis
R579 Ritchey
c.1 Use of pattern analysis for predicting heroin dependency.
145496